524 Rec'd PCT/PTO 17 AUG 1999

FORM PTO-1390 (Modified) (REV 1-95) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR
RCA89726	09/367623

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FR98/00295	16 FEBRUARY 1998	17 FEBRUARY 1997

TITLE OF INVENTION

METHOD FOR AUTOMATICALLY MATCHING THE LEVELS OF THE SIGNALS EXCHANGED IN A COMMUNICATION NETWORK

APPLICANT(S) FOR DO/EO/US

THOMSON MULTIMEDIA

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
    A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☒ Other items or information:

CERTIFICATE OF MAILING UNDER 37 CFR 1.10

EL278373632US — **August 17, 1999**
"EXPRESS MAIL" Mailing No. — **Date of Deposit**

I hereby certify that this application is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, DC 20231

Helen Chapko
Typed or printed name of person mailing application

Signature of person mailing application

PCTUS1/REV03

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U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/367623	PCT/FR98/00295	RCA89726

20. The following fees are submitted:.		CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :			
☒ Search Report has been prepared by the EPO or JPO	**$840.00**		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482)	**$670.00**		
☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	**$760.00**		
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO	**$970.00**		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	**$96.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =		**$840.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).		**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	10 - 20 =	0	x $18.00	**$0.00**	
Independent claims	2 - 3 =	0	x $78.00	**$0.00**	
Multiple Dependent Claims (**check if applicable**).			☐	**$0.00**	
	TOTAL OF ABOVE CALCULATIONS =			**$840.00**	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (**check if applicable**).			☐	**$0.00**	
	SUBTOTAL =			**$840.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	**$0.00**	
	TOTAL NATIONAL FEE =			**$840.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (**check if applicable**).			☐	**$0.00**	
	TOTAL FEES ENCLOSED =			**$840.00**	
				Amount to be: refunded	$
				charged	$

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **07-0832** in the amount of **$840.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **07-0832** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Joseph S. Tripoli
THOMSON MULTIMEDIA LICENSING INC.
PO Box 5312
2 Independence Way
Princeton, NJ 08545

PCT INITIAL PROCESSING
AUG 20 1999
RECEIVED

Peter M. Emanuel
SIGNATURE

Peter M. Emanuel
NAME

26,542
REGISTRATION NUMBER

8-17-99
DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Christophe Lorin
Int'l Appln. No	:	PCT/FR98/00295
Filed	:	Herewith
For	:	METHOD FOR AUTOMATICALLY MATCHING THE LEVELS OF THE SIGNALS EXCHANGED IN A COMMUNICATION NETWORK

PRELIMINARY AMENDMENT

Honorable Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In the US national phase application of PCT/FR98/00295 filed herewith, please enter the following amendments:

In the Specification:

Please amend the specification (which are the annexes of the International Preliminary Examining Report) as follows:

On Page 1, at line 16, delete [station] and insert exchange.

On Page 2, before line 14, please insert the following paragraph:

-- Document US 5422950 (Miller et al.) relates to the automatic compensation for attenuations in a telephone system. The estimate of the impedance of the line is made by measuring the voltage on the lines 28, 30 for a particular current using a simple resistance-measuring circuit 42. The subject matter of document US 422950 does not solve the problem mentioned above. --

On Page 4, at line 24, delete [station] and insert exchange.

In the Claims

Please amend the claims (which are annexes of the International Preliminary Examining Report) as follows:

In Claim 1, line 4, delete [(IN1, OUT2)],
line 5 delete [(3)] and [(4)],
line 6, delete [(2)],
line 7, delete [(6)],
line 9, delete [(OUT2)],
line 10, delete [(6)],
line 11, delete [(2)],
line 13, delete [(IN1, OUT2)],
line 14, delete [(6)],
line 15, delete [(K)] and [(OUT2)],
line 16, delete [(IN1],
line 18, delete [(IN1, OUT2)],
line 19, delete [(G1, G2)],
line 20, delete [(K)].

In Claim 2, line 24, delete [(K)],
line 30, delete [(6)],
line 31, delete [(6)],
line 35, delete [G2].

In Claim 3, line 1, delete [or 2],
line 2, delete [(G2)] and [(OUT2)],
line 4, delete [(IN2)],
line 5, delete [(OUT2)],
line 6, delete [(ZL)].

In Claim 4, line 8, delete [one of Claims 1 to 3], and insert Claim 1,
line 9, delete [(G1)] and [(IN1)],
line 11, delete [(IN1)] and [(OUT2)],
line 13, delete [(ZL)].

In Claim 5, line 14, delete [one of Claims 3], and insert Claim 3..

In Claim 6, line 18, delete [(IN1, OUT2)],
line 19, delete [(3)] and [(4)],
line 20, delete [(6)],
line 21, delete [(46)].
line 22, delete [(OUT2)],
line 23, delete [(3)],
line 24, delete [(40)],
line 26, delete [(10)].
line 27, delete [(OUT2)],
line 28, delete [(IN1)],
line 29, delete [(IN1, OUT2)].

In Claim 7, line 34, delete [(10)] and [(12)],
line 35, delete [(K)],
line 36, delete [(14)],
line 37, delete [(16)] and [(G1)],
line 38, delete [(IN1)],
line 17, delete [(82)],
line 19, delete [(85)],
line 20, delete [(88)],
line 22, delete [(90)],
line 1, delete [(18)] and [(G2)],
line 2, delete [(OUT2)].

In Claim 8, line 4, delete [one of Claims 5 to 7] and insert Claim 5,
line 5, delete [(10)],

In Claim 10, line 10, delete [(3)],
line 11, delete [one of Claims 6 to 9] and insert Claim 6.

In the Abstract

Please add the attached abstract and delete the following:
At line 6, delete [(OUT2)] and [(6)],
line 7, delete [(2)],

line 8, delete [(IN1, OUT2)] and [(6)],
line 9, delete [(K)] and [(OUTS)],
line 10, delete [(IN1)],
line 11, delete [(IN1, OUT2)] and [(G1, G2)],
line 12, delete [(K)],

ABSTRACT

The invention concerns a method and a device for automatically adapting the levels of signals exchanged in a telephone network, between a first set and a second set. The method is characterised in that it consists in the following steps: digitising the signal (OUT2) coming from the transmission line (6) and received by the first set (2); on the basis of the digital data translating the signals (IN1, OUT2) exchanged with the transmission line (6), estimating the transfer function (K) equal to the ratio of the signal (OUT2) received by the first set over the signal (IN1) transmitted by the first set; respectively multiplying each of the exchanged signals (IN1, OUT2) by an appropriate gain (G1, G2) determined on the basis of the estimated value of said transfer function (K). The invention is particularly applicable to telephones, videophones, fax machines or computers connected to a communication network.

REMARKS

The above claims have been amended to remove reference indicia and multiple dependencies. No new matter has been added.

To meet the requirements of the United States, the Abstract is added. The abstract as amended during the prosecution of the PCT application has been amended to remove reference indicia.

No fee is believed to been incurred by virtue of this amendment. However, if a fee is incurred on the basis of this amendment, please charge such fee against deposit account 07-0832.

Respectfully Submitted,
Christophe Lorin

By: Peter M. Emanuel

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METHOD FOR AUTOMATICALLY MATCHING THE LEVELS OF THE SIGNALS EXCHANGED IN A COMMUNICATION NETWORK

2/PRTS

The present invention relates to a method for automatically matching the levels of the signals exchanged between apparatuses such as telephones, videophones (system for transmitting voice and video via the telephone network), faxes or computers which are connected to a communication network. The invention also relates to an automatic matching device.

The invention relates in particular to a method for automatically matching the levels of the signals exchanged in a telephone network.

Figure 1 schematically represents a subscriber loop 2 in a known architecture of a telephone network, connecting a user to a telephone station 4. The user transmits a signal IN1 and receives a signal OUT2 through a transmission line 6 which is represented by its impedance Z_L. This impedance has a detrimental effect on the signals exchanged between the user and the station.

One solution for correcting the distortions introduced by the analogue transmission line consists in measuring a DC voltage V_{dc} across the terminals of a load 7 which is connected to the line through an inductor L1, given that the capacitors C1, C2 act as filters for low-frequency signals while the inductors L1, L2 filter the high-frequency signals. This voltage V_{dc} is then delivered to a calculation module 8 which, on the basis of the result of this measurement, determines a value for Z_L. The calculation module also determines a gain G1, chosen so that the gain of IN1 at the point VL2 does not depend on Z_L, a gain G2, chosen so that the gain of IN2 in the signal OUT2 does not depend on Z_L either, and a gain G3 which is chosen so as to suppress the sent signal IN2 from the received signal OUT2 and acts as an echo canceller (G3 is not shown in Figure 1).

It can be determined that:

$$OUT2 = \frac{IN1}{2} * \left[\frac{Z_L}{Z_L + 2R_1} \right] + IN2 * \left[\frac{R_1}{Z_L + 2R_1} \right]$$

In this case, setting:

$$G1 = G2 = \frac{Z_L}{2R_1} + 1$$

and

$$G3 = 2 * \frac{Z_L + R_1}{Z_L + 2R_1}$$

the following are obtained: OUT1=0.5*IN1 and OUT2=0.5*IN2

This solution is not suitable for compensating the signals exchanged by digital apparatuses, which need to be isolated from the subscriber loop and which do not therefore have access to the line impedance Z_L via a direct voltage/current measurement.

The object of the invention is to reduce the effect of the line impedance, and to do so even though the direct measurement described above is impossible.

This object is achieved by a method for automatically matching the levels of the signals exchanged between a first apparatus and a second apparatus which communicates with the said first apparatus via a transmission line, characterized in that it comprises the following steps:

- the signal which comes from the transmission line and is received by the first apparatus (2) is digitized,
- on the basis of the digital data representing the signals exchanged with the transmission line, an estimate is made of the transfer function equal to the ratio of the signal received by the first apparatus to the signal (IN1) transmitted by the first apparatus,
- each of the exchanged signals (IN1, OUT2) is respectively multiplied by a suitable gain (G1, G2) determined on the basis of the estimated value of the said transfer function (K).

With the method according to the invention, it is no longer necessary to measure a DC voltage in order

to determine the gains needed for the compensation, since the solution employed is essentially digital, that is to say software-based, and can therefore be employed for compensating the level of the signals exchanged in applications using digital apparatuses which are isolated from the subscriber loop, such as videophones, faxes or computers. The method allows, dynamically, operation in full duplex mode which is independent of temperature variations so long as at least one signal transmission out from the apparatus has been made in order to ascertain the initial characteristics of the line.

It may be advantageous for the numerical estimate making it possible to evaluate the transfer function (K) to be made using a software calculation method.

According to one embodiment, this calculation method implements an identification algorithm.

Preferably, the identification algorithm is of the LMS (Least Mean Square), RLS (Recursive Least Square) or Kalman type.

The invention also relates to a device for automatically matching the levels of signals exchanged between a first apparatus (3) and a second apparatus communicating via a transmission line, characterized in that it has:

- an analogue/digital converter capable of digitizing a signal entering the first apparatus,

- a digital/analogue converter capable of converting a signal transmitted by the first apparatus,

- a calculation block intended to estimate the ratio of the incoming signal to the signal transmitted by the first apparatus, and to determine the gains needed for matching the levels of the signals transmitted and received by the first apparatus, the said gains being dependent on the said ratio.

According to one embodiment, the numerical calculation block has a unit for identifying the transfer function interacting with a calculation module

which is intended to supply a first amplification means with the first gain for matching the level of the signal transmitted by a user, and to supply a second amplification means with the second gain for matching the level of the signal received by the user.

Advantageously, the calculation block is a DSP (Digital Signal Processing) circuit implementing an identification algorithm.

Other characteristics and advantages of the invention will become apparent from the following description, made by way of nonlimiting example and with reference to the appended figures, in which

- Figure 1, already described, schematically represents a subscriber loop in a telephone network according to a prior art architecture,

- Figure 2 schematically represents a subscriber loop in a telephone network having a device for automatically matching the levels of the signals exchanged according to the invention, and

- Figure 3 schematically represents a similar subscriber loop to Figure 2, implementing an echo canceller.

Figure 2 schematically illustrates a link between a apparatus 3 of a user and a telephone station 4 via a transmission line 6 which is represented by its impedance Z_L. The user transmits a signal IN1 and receives a signal OUT2, while the station 4 transmits a signal IN2 and receives a signal OUT1.

In order to avoid the attenuation due to the impedance Z_L of the line 6 which the signals IN1 and OUT2 suffer, and in order to keep the transfer functions for the signal IN1, at the point VL2, and for the signal OUT2 independent of the line impedance, the method according to the invention has a step of digitizing the signal entering the said apparatus, a step of estimating the transfer function K as a function of the exchanged signals OUT2 and IN1, then a step of multiplying each signal by a suitable gain

determined on the basis of the value of the transfer function K determined beforehand.

When the signal IN1 is transmitted, the signal OUT2 detected at the output of the subscriber loop is applied to an analogue/digital converter 44 which digitizes the said signal OUT2.

The estimate of the transfer function K is made numerically by an identification algorithm based, for example, on the method of least squares, the RLS (Recursive Least Square) algorithm or alternatively on the Kalman algorithm. The algorithm has the function of calculating the characteristic parameters of the transfer function K, which may in particular be a matrix $(h_i)_{1\leq i\leq n}$ or a polynomial fraction in $(Z_L^{-i})_{1\leq i\leq n}$.

In the present embodiment, the calculation consists in firstly determining the ratio:

$$\frac{OUT2}{IN1} = K(Z_L) + \varepsilon$$

where

$$K(Z_L) = \frac{Z_L}{2\cdot(Z_L + 2\cdot R_1)}$$

This being true in the present embodiment with an impedance Z_L which is assumed to be constant. It is clear that the source impedance is equal to the input impedance of the line for a short line $Z_L=0$ and the input impedance of the line is dependent on the characteristic impedance Z_c and on the load impedance Z_R; in the present case, Z_R is equal to the source impedance R1. For the sake of simplicity, the condition $Z_L=Z_c$ is set.

A step subsequent to this calculation consists in determining:

for the transmitter signal, a first gain

$$G1(Z_L) = \frac{Z_L}{2R_1} + 1 = \frac{1}{1-2\cdot K(Z_L)}$$

and for the received signal, a second gain

$$G2(Z_L) = \frac{1}{1-2\cdot K(Z_L)}.$$

It can be seen that for these values of gains, the voltage OUT2 at the ends of the transmission line

is equal to half the voltage VL2 (apart from echoes of IN1).

The device in Figure 2 has a numerical calculation block 10 intended to estimate the impedance Z_L of the transmission line and to determine the gains needed for compensating the exchanged signals. This numerical calculation block 10 has a unit 12 for identifying the transfer function K interacting with a calculation module 14 which is intended to supply a first amplification means 16 with the first gain G1 for compensating for the attenuation of the signals transmitted by the user, and to supply a second amplification means 18 with a second gain G2 for compensating for the attenuation of the signal received by the user.

Preferably, the numerical calculation block 10 is a DSP (Digital Signal Processing) circuit employing one of the identification algorithms mentioned above. Another type of circuit may, of course, be used.

As can be seen in Figure 2, a first input 20 of the identification unit 12 is connected to the output 21 of the first amplification means 16, while a second input 22 of the said identification unit 12 is connected to a first input 23 of the second amplification means 18. The output 24 of the identification unit 12 is connected to the input 26 of the calculation module 14. A first output 28 of the calculation module 14 is connected to a first input 30 of the first amplification means 16, while a second output 32 of the calculation module 14 is connected to a second input 34 of the second amplification means 16. The output 36 of the numerical calculation block 10 is connected to an input 38 of a digital/analogue converter 40, while the input 42 of the said numerical calculation block 10 is connected to the output 44 of an analogue/digital converter 46.

During operation, the identification unit 12 supplies the calculation module 14 with an estimated value of the transfer function K, calculated on the

basis of the values of the signals transmitted and of the signals received by the user. These signals are applied respectively to the first input 20 and to the second input 22 of the identification unit 12.

The calculation module 14 supplies the first amplification means 16 with the first gain G1 in order to compensate for the attenuation of the signals transmitted by the user, and supplies the second amplification means 18 with the second gain G2 in order to compensate for the attenuation of the signals received by the user.

The method and the device of the invention thus make it possible to perform automatic matching of the levels of the signals exchanged through a transmission line. Furthermore, this system is not sensitive to temperature drifts which can affect the voltage measurement advocated in the prior art, such as that across the terminals of the load 7 in Figure 1. The method is thus independent of the variations in the power source X of the telephone network.

Knowledge of the transfer function $K(Z_L)$ can also be used to detect the presence of a parallel connection of the device of the invention in the transmission line. The said detection method includes a step of observing the sign of the gain of the identified transfer function K. When the sign is negative, then it is deduced that a second set is connected in parallel with the transmission line. This information can be used, for example, without implying any limitation, for security reasons in the case of using a modem and a telephone. If detection is made by the modem then the latter can hang up to free the line.

Figure 3 is similar to Figure 2, with the same elements having the same references. However, echo-cancelling means are furthermore introduced into the device. In practice, this is equivalent to making OUT2 independent of IN1. To that end, a third gain, G3, is introduced which is applied to IN1 by means of an amplifier 49. The whole is subtracted from OUT2 by a

subtractor 50, before amplification by G2. It can be shown that, in order to cancel the echo, it is necessary that $G3=K(Z_L)$.

CLAIMS

1. Method for automatically matching the levels of the signals (IN1, OUT2) exchanged between a first apparatus (3) and a second apparatus (4) which communicates with the said first apparatus (2) via a transmission line (6), characterized in that it comprises the following steps:

- the signal (OUT2) which comes from the transmission line (6) and is received by the first apparatus (2) is digitized,

- on the basis of the digital data representing the signals (IN1, OUT2) exchanged with the transmission line (6), an estimate is made of the transfer function (K) equal to the ratio of the signal (OUT2) received by the first apparatus to the signal (IN1) transmitted by the first apparatus,

- each of the exchanged signals (IN1, OUT2) is respectively multiplied by a suitable gain (G1, G2) determined on the basis of the estimated value of the said transfer function (K).

2. Method according to Claim 1, characterized in that it comprises the following steps:

- the estimate of the transfer function (K) defined in the following way is made:

$$\frac{OUT2}{IN1} = K(Z_L) + \varepsilon$$

where

$$K(Z_L) = \frac{Z_L}{2 \cdot (Z_L + 2 \cdot R_1)}$$

and Z_L represents the impedance of the transmission line (6), while R1 represents the source impedance of the transmission line (6),

- the following are calculated:

for the transmitter signal, the first gain G1

$$G1(Z_L) = \frac{1}{1 - 2 \cdot K(Z_L)}$$

and for the received signal, the second gain G2

$$G2(Z_L) = \frac{1}{1 - 2 \cdot K(Z_L)} \quad .$$

3. Method according to Claim 1 or 2, characterized in that the gain (G2) of the signal (OUT2) received by the first apparatus is chosen so that the component of the signal transmitted by the second apparatus (IN2) in the signal (OUT2) received by the first apparatus is independent of the impedance (ZL) of the transmission line.

4. Method according to one of Claims 1 to 3, characterized in that the gain (G1) of the signal (IN1) transmitted by the first apparatus is chosen so that the component of this signal (IN1) in the signal (OUT2) received by the second apparatus is independent of the impedance (ZL) of the transmission line.

5. Method according to one of Claims 3, characterized in that the said calculation method implements an identification algorithm.

6. Device for automatically matching the levels of signals (IN1, OUT2) exchanged between a first apparatus (3) and a second apparatus (4) communicating via a transmission line (6), characterized in that it has:

- an analogue/digital converter (46) capable of digitizing a signal (OUT2) entering the first apparatus (3),

- a digital/analogue converter (40) capable of converting a signal transmitted by the first apparatus,

- a calculation block (10) intended to estimate the ratio of the incoming signal (OUT2) to the signal (IN1) transmitted by the first apparatus, and to determine the gains (G1, G2) needed for matching the levels of the signals transmitted and received by the first apparatus (IN1, OUT2), the said gains being dependent on the said ratio.

7. Device according to Claim 6, characterized in that the block (10) has a unit (12) for identifying the transfer function (K) interacting with a calculation module (14) which is intended to supply a first amplification means (16) with the first gain (G1) for matching the level of the signal (IN1) transmitted by the first apparatus, and to supply a second

amplification means (18) with the second gain (G2) for matching the level of the signal (OUT2) received by the first apparatus.

8. Device according to one of Claims 5 to 7, characterized in that the calculation block (10) has a DSP circuit implementing an identification algorithm.

9. Device according to Claim 8, characterized in that the identification algorithm is of the LMS, RLS or Kalman type.

10. Communication apparatus (3), characterized in that it has a device according to one of Claims 6 to 9.

ABSTRACT

METHOD FOR AUTOMATICALLY MATCHING THE LEVELS OF THE SIGNALS EXCHANGED IN A COMMUNICATION NETWORK

The invention relates to a method and to a device for automatically matching the levels of the signals exchanged in a telephone network, between a first apparatus and a second apparatus.

The method according to the invention comprises the following steps:

- the signal (OUT2) which comes from the transmission line (6) and is received by the first apparatus (2) is digitized,
- on the basis of the digital data representing the signals (IN1, OUT2) exchanged with the transmission line (6), an estimate is made of the transfer function (K) equal to the ratio of the signal (OUT2) received by the first apparatus to the signal (IN1) transmitted by the first apparatus,
- each of the exchanged signals (IN1, OUT2) is respectively multiplied by a suitable gain (G1, G2) determined on the basis of the estimated value of the said transfer function (K).

Particular application to telephones, videophones, faxes or computers which are connected to a communication network.

Figure 2.

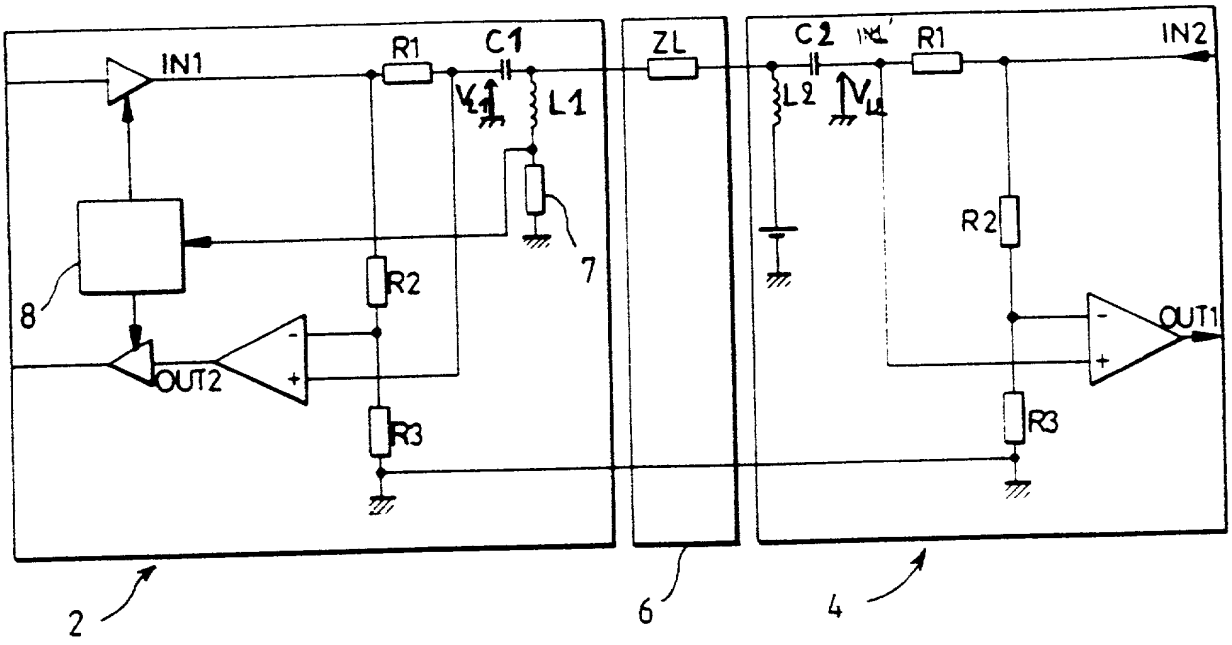

FIG.1

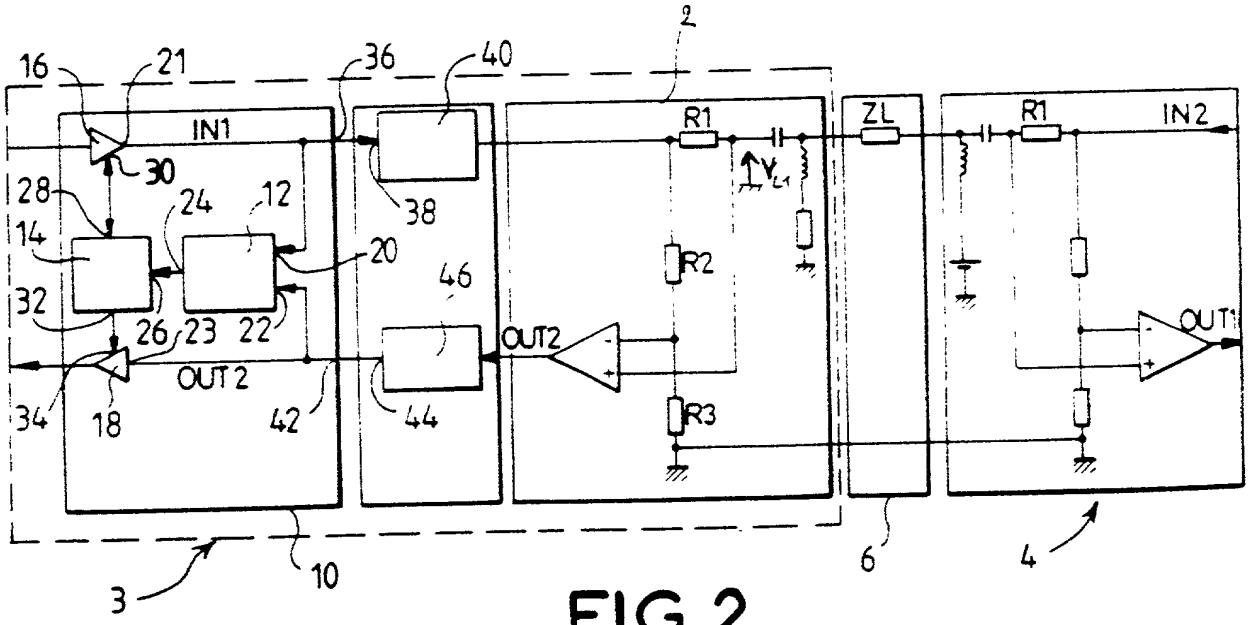

FIG.2

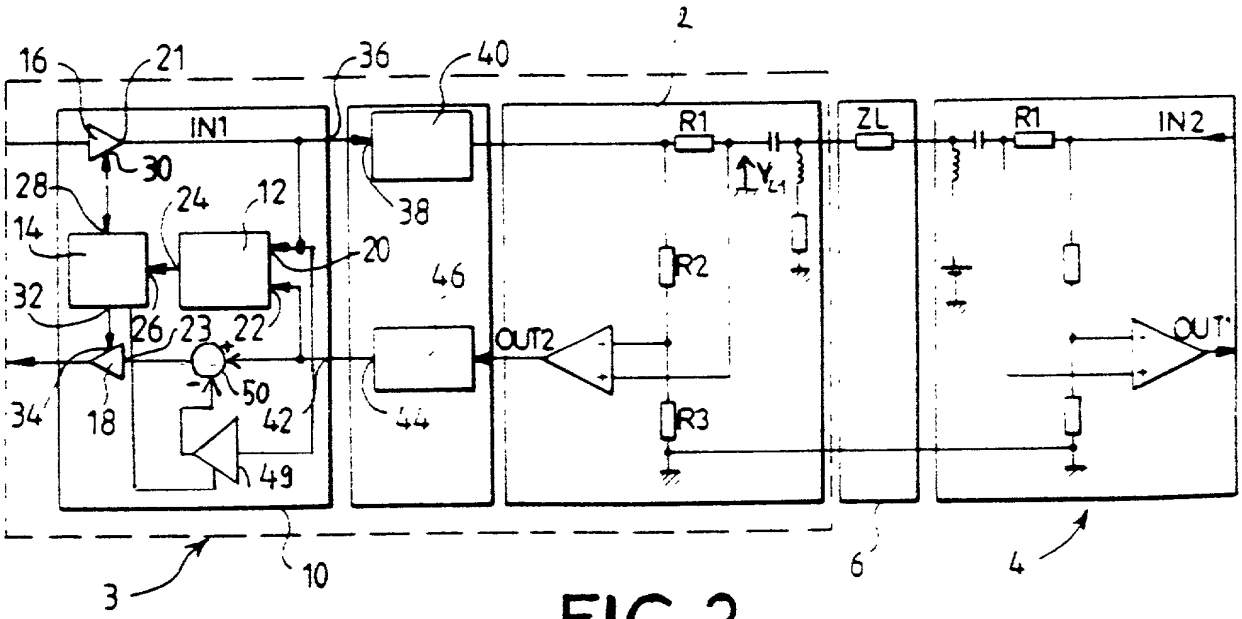

FIG.3

DECLARATION FOR UNITED STATES PATENT APPLICATION,
POWER OF ATTORNEY, DESIGNATION OF CORRESPONDENCE ADDRESS

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and that I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"METHOD FOR AUTOMATICALLY MATCHING THE LEVELS OF THE SIGNALS EXCHANGED IN A COMMUNICATION NETWORK"

the specification of which
(CHECK ONE) ( ) is attached hereto.
(xx) was filed on February 16 1998, Application Serial. PCT/FR98/00295 and was amended on

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR 1.56(a).

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent, utility model, design or inventor's certificate having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
Number	Country	Date Filed	Yes	No
9701827	FR	February 17, 1997	xx	

I hereby claim the benefit under 35 USC 120 of any US Application(s) listed below, and, insofar as the subject matter of each of the claims of this Application is not disclosed in the prior US application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR 1.56(a).

Serial No.: Filed:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under of 18 USC 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Joseph S. Tripoli (Reg. No. 26,040), Peter M. Emanuel (Reg. No. 26,542), Joseph J. Laks (Reg. No. 27,914), Eric Herrmann (Reg. No. 29,169) Telephone: (609) 734-9754

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Signature: _____ Date: 25th of August, 1999.
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